ABSTRACT

Small particles, for example 5 μm diameter microspheres or cells, within, and moving with, a fluid, normally water, that is flowing within microfluidic channels within a radiation-transparent substrate, typically molded PDMS clear plastic, are selectively manipulated, normally by being pushed with optical pressure forces, with laser light, preferably as arises from VCSELs operating in Laguerre-Gaussian mode, at branching junctions in the microfluidic channels so as to enter into selected downstream branches, thereby realizing particle switching and sorting, including in parallel. Transport of the small particles thus transpires by microfluidics while manipulation in the manner of optical tweezers arises either from pushing due to optical scattering force, or from pulling due to an attractive optical gradient force. Whether pushed or pulled, the particles within the flowing fluid may be optically sensed, and highly-parallel. low-cost, cell- and particle-analysis devices efficiently realized, including as integrated on bio-chips.